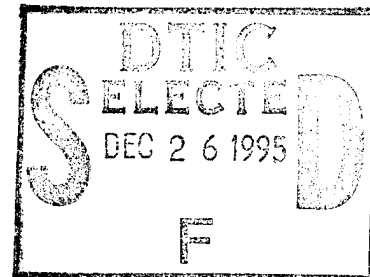# FINAL TECHNICAL REPORT

December 14, 1995

DURIP/ONR Grant No. N00014-95-1-0348

Title: Instrumentation for Coordinate Metrology

The instrumentation acquired under this grant will support several ongoing and proposed research activities at the Applied Research Laboratory and the College of Engineering at The Pennsylvania State University.

The major research area to be supported by the acquired instrumentation is an effort in tolerance specification and assessment to improve turbomachinery affordability. The instrumentation will enable designers to accurately assess the impact of the as-built dimensions of prototype turbomachinery on performance. Other research efforts the equipment will support includes statistical tolerance evaluation, off-line programming, and inspection planning.

The following instrumentation was purchased under this grant:

Equipment:	RS-50 Apollo II Coordinate Measuring Machine (CMM)
Manufacturer:	Giddings and Lewis
Cost:	$155,152

Equipment:	INDIGO2 XZ Graphics Workstation
Manufacturer:	Silicon Graphics Computer Systems
Cost:	$23,470

Equipment:	Cimstation Inspection
Manufacturer:	Silma, Inc.
Cost:	$9,750

Equipment:	Zeiss U-Soft CNC Coordinate Measuring Machine Upgrade
Manufacturer:	Carl Zeiss
Cost:	$29,850
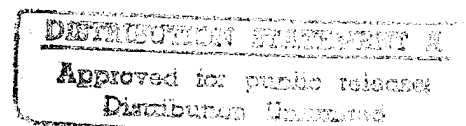
There were special circumstances which required a change from the proposal upon which this grant was made. In doing the review of CMMs prior to purchase, we found that we were unable to adequately do path planning for inspection of turbomachinery using software provided with the CMMs. The planning of collision-free access of the 5 axis probe is very difficult, and collisions can easily ruin the CMM probe. This path planning is instrumental to the research described in the original proposal. To address this problem, we evaluated several off-line graphical programming tools which enable paths to be generated and checked in a simulated environment, prior to running them on the CMM. This type of software needs to be run on a graphical type workstation computer. With the concurrence of the Scientific Officer and the approval of the

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Administrative Grants Officer, the Cimstation Inspection software and a Silicon Graphics workstation computer were acquired to assist in performing path planning for the CMM.

In addition, some security sensitive inspection work planned for the new CMM in the near future at ARL would likely have made it difficult for students in the Department Industrial Engineering to get free access to the machine. As an alternative, we proposed doing a software upgrade and replacing the probe on an existing CMM in the IE Department laboratory. This CMM , while rather small, will provide a starting point for student research, enabling them to move to the new, larger CMM when research needs dictate and when the new machine is available for use. This change was also approved by the Scientific Officer and the Administrative Grants Officer.

These additional acquisitions of instrumentation were made possible within the Grant and matching funds budget due to saving realized when we were able to make use of a precision rotary table from an old, laser based inspection system the Applied Research Laboratory recently salvaged.

At the date of this report, the following tasks have been accomplished:

- the room for the CMM has been retrofitted, and all utilities and computer network connections have been established.
- the CMM has been delivered, installed, and calibrated.
- the Silicon Graphics workstation and Silma software have been received and are functional.
- the Zeiss upgrade order has been placed.
- Applied Research Laboratory employees are scheduling training sessions on the operation and programming of the CMM.

We expect to be fully functional with the instrumentation within 6 months.

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REPORT DOCUMENTATION PAGE

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12b. DISTRIBUTION CODE

13. ABSTRACT (Maximum 200 words)
This report describes instrumentation acquired by The Pennsylvania State University under a Defense University Research Instrumentation Program (DURIP) grant. The instrumentation will support several research programs in the area of coordinate metrology.

14. SUBJECT TERMS
Inspection, Coordinate Measurement, Metrology

15. NUMBER OF PAGES
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16. PRICE CODE

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Standard Form 298 (Rev. 2-89)
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298-102

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G	-	Grant	**TA** - Task
PE	-	Program Element	**WU** - Work Unit Accession No.

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